**STATISTICS FOR ENGINEERS**

## Exercise Sheet 5

*Hand in solutions to the two starred questions.*

**1.*** The following measurements of the specific heat of a certain chemical were made in order to investigate the variation of specific heat with temperature.

| Temperature ($^oC$) | 0 | 10 | 20 | 30 | 40 |
|---|---|---|---|---|---|
| Specific heat | 0.51 | 0.55 | 0.57 | 0.59 | 0.63 |

(i) Plot the data on a scatter diagram, estimate the linear regression of specific heat on temperature and draw the estimated line on the diagram.
(ii) Find a 95% confidence interval for the slope of the regression line, stating assumptions
(iii) Find a 95% confidence interval for the mean specific heat at $15^oC$.
(iv) Calculate the correlation coefficient

**2*.** Use the Acceptance Sampling Tables to find the optimal one-stage sampling plan if the acceptable quality level is $p = 0.01$, the unacceptable quality level is $p = 0.06$, where $p$ is proportion of defectives items in the batch; the Producer's and Consumer's Risks are to be no larger than 0.05.

Find the precise values of the Producer's and Consumer's Risks in this case.

**3.** In a two-stage sampling scheme, 60 items are selected at random from a large batch. If more than 2 items are faulty, the batch is rejected and if none are faulty, the batch is accepted, Otherwise, a further 60 items are sampled at random; if more than 3 out of the 120 items are faulty, the batch is rejected, otherwise it is accepted.
(i) Find the probability that the batch is rejected if the proportion of faulty items in the batch is 0.02.
(ii) What is the average number of items sampled when the proportion of faulty items in the batch is 0.02?

**4.** (i) The probability density function of the time till failure of a component is $\frac{4}{(1+t)^5}$, for $t > 0$. Find the failure rate.

(ii) The failure rate of a component is $1 + t$ for $t > 0$. Find the probability density function of the time till failure. Write down an expression in terms of an integral for the mean time till failure of the component. (You need not evaluate this expression.)